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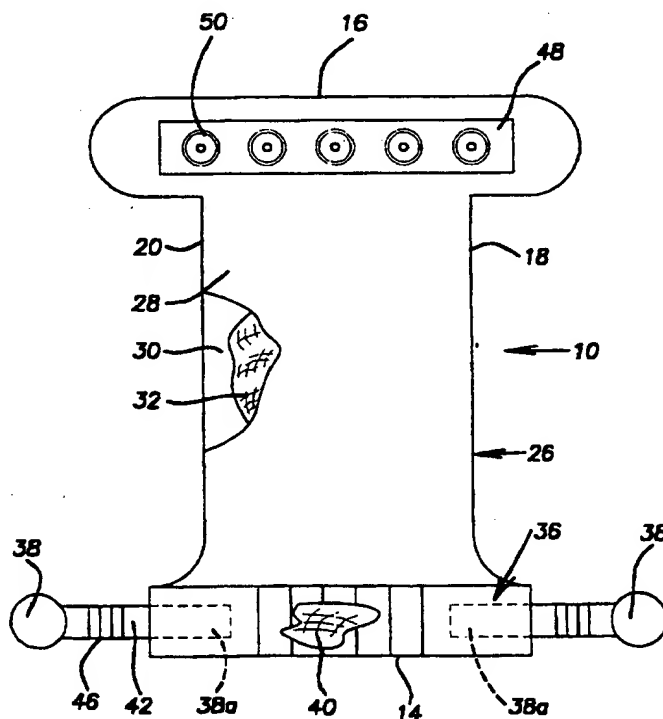
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(54) Title: DISPOSABLE DIAPER WITH WAIST BELT STRUCTURE

(57) Abstract

A disposable diaper (10, 60, 80, 100, 120) includes a laminate (12) extending between first and second diaper ends (14, 16), and includes a waistband (34, 62, 82, 102, 122) adjacent the first diaper end (14) and a fastening system (38, 48, 66, 72, 86, 92, 106, 112, 126, 132) movable between an open and a closed position for releasably securing the diaper to a user. The waistband forms a tubular belt loop (36, 64, 84, 104, 124) extending along the first diaper end (14) to eliminate exposure of the edge or edges of the laminate (12) to the diaper user. The fastening system includes a fastener belt (38, 66, 86, 106, 126) mounted within each end of the waistband loop (36, 64, 84, 104, 124) by a factory joint (38a) whereby the tubular loop also eliminates exposure of the factory joints (380) to the diaper user. Mechanical (44, 44a, 50, 50b, 68, 70), mechanical/adhesive (88, 90, 108, 110, 128, 130) fastening or mechanical/cohesive (88, 90, 108, 110, 128, 130) fastening elements are carried by the fastener belts (58, 66, 86, 106, 126) and a diaper landing zone (48, 72, 92, 112, 132).



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1                   DISPOSABLE DIAPER WITH WAIST BELT STRUCTURE

2                   This application claims priority of US Provisional  
3                   Application No. 60/012,347, filed February 27, 1996.

4                   BACKGROUND OF THE INVENTION AND RELATED ART

5                   The present invention relates to disposable diapers  
6                   having a fastening system for closing the diaper about  
7                   the user's body and, more particularly, to a disposable  
8                   diaper having a complete waist belt structure and more  
9                   convenient closure systems.

10                  Diapers of this type are usually provided with a  
11                  generally rectangular configuration and a layer  
12                  construction. A typical diaper comprises an absorbent  
13                  pad or batt or the like enclosed in a liquid impermeable  
14                  outer backsheet and a liquid permeable inner top sheet.  
15                  The backsheet may comprise a plastic film of polyethylene  
16                  or a non-woven fabric laminated with a water impermeable  
17                  layer such as a polyethylene film. The top sheet  
18                  comprises a water permeable fabric or non-woven shell or  
19                  liner that promotes separation of fluid from the user.  
20                  The top sheet and the backsheet are sealed together along  
21                  their overlying longitudinal edges, the opposed end edges  
22                  being formed by cutting the layers and being unsealed.

23                  The fastener tape system generally includes adhesive  
24                  tabs fastened to one end of the diaper assembly  
25                  construction at each lateral side of the diaper in a  
26                  permanent "factory joint" by the diaper manufacturer  
27                  using adhesives or other techniques. The tabs have a  
28                  face coated with pressure-sensitive adhesive. The tabs  
29                  are releasably attachable to the other end of the diaper  
30                  at each lateral side in a "user joint". The attachment  
31                  is releasable both to allow permanent removal of the  
32                  diaper and to allow unfastening to inspect the diaper  
33                  followed by refastening if indicated.

1           The user joint may be formed by direct connection of  
2           the tab to the diaper outer surface or backsheet whether  
3           the latter is formed of a plastic film or a non-woven.  
4           In the case of plastic films, it is typical to provide a  
5           "landing zone" formed of reinforcing tape or the like for  
6           receiving the end of the tab to form the user joint. The  
7           landing zone may provide a plastic surface or a nonwoven  
8           surface and may comprise a knit type fabric landing pad.

9           When the diaper is fitted to a baby, the fastener  
10          tabs typically extend from the longitudinal edges  
11          adjacent one end of the backsheet to the landing zone or  
12          area on the other lateral end of the backsheet that is  
13          positioned over the user's or baby's abdomen.  
14          Accordingly, the fastener tabs may be readily grasped by  
15          the baby and possibly pulled open.

16          The fastener tape system may rely solely upon  
17          pressure-sensitive adhesive in the formation of the user  
18          joint as shown in US Patents 4,795,456 4,710,190,  
19          4,020,842 and 3,833,456. The use of combined adhesive  
20          and mechanical fastener systems is shown in US Patents  
21          5,019,065, 5,053,028 and 4,869,724. The teachings of all  
22          of these patents being incorporated herein by reference.

23          The use of extensible or stretchable tabs to promote  
24          user comfort through better fit and more secure mounting  
25          is also known in the art. The tabs operate as extensible  
26          diaper side waistbands. Examples of such diaper  
27          fastening systems are disclosed in US Patents 4,795,456,  
28          4,066,081, 4,051,853 and 3,800,796.

29          Related art includes US Patents 2,499,898,  
30          2,548,004, 3,038,225, 3,064,268, 3,089,494, 3,454,993,  
31          4,189,809, 4,880,421, 5,097,570, 5,119,531, 5,345,659,  
32          5,440,787 and 5,545,159.

SUMMARY OF THE INVENTION

The present invention contemplates diaper constructions including a substantially complete waistband. The waistband provides improved comfort and more uniform securement tension to the baby with accompanying improvements in sealing.

The waistband construction combines fastener belts with a continuous waistband adjacent each end of the diaper. The belts are secured by a factory joint to the diaper within opposed ends of the waistband. Upon closure of the diaper, a substantially complete waistband effect is achieved.

The waistband is formed with closed upper edges that are more comfortable and less irritating to the baby's skin as compared with the prior art unsealed open ends and exposed layer edges. Similarly, the waistband conceals the factory joints that secure the fastener belts to the diaper. The waistband may be provided with a soft filled construction to further enhance the baby's comfort and the sealing of the diaper contents.

The waistband also includes several mechanical closure systems that are more conveniently manipulated than the prior art adhesive fastener tapes or hook/loop type tabs. Also, the relatively larger dimensions of the mechanical engaging elements of the invention substantially reduce, if not eliminate, the prior art problems involving crushing the hooks/loops during manufacture or processing, especially in roll manipulation. Certain of the closures combine both mechanical and adhesive or cohesive engagement to further improve the security of the diaper closure.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view showing a diaper having a waistband in accordance with the invention, the diaper being shown in a flat condition;

Fig. 2 is a schematic fragmentary perspective view showing the waistband of the diaper of Fig. 1 in a configuration if fitted to an infant and having one of the fastener belts engaged and one opened;

Fig. 3 is a fragmentary perspective view on an enlarged scale showing the closure system of the waistband of the diaper of Fig. 1;

Fig. 4 is a perspective view similar to Fig. 2 showing a second embodiment of a waistband in accordance with the invention;

Fig. 5 is fragmentary sectional view on an enlarged scale showing the closure system of the waistband of the diaper of Fig. 4;

Fig. 6 is a perspective view showing a diaper having a waistband in accordance with another embodiment of the invention, the waistband being shown in the open condition;

Fig. 7 is a perspective view similar to Fig. 6 showing the diaper of Fig. 6 with the waistband in a closed position;

Fig. 8 is a fragmentary perspective view on an enlarged scale showing the closure system of the waistband of the diaper of Fig. 6;

Fig. 9 is a perspective view showing a diaper having a waistband in accordance with a further embodiment of the invention, the diaper being shown in a flat condition;

Fig. 10 is a schematic fragmentary perspective view showing the waistband of the diaper of Fig. 9 in a configuration as if fitted to an infant and having one of the fastener belts engaged and one opened;

1           Fig. 11 is a schematic perspective view of an  
2           alternative closure for use in the waistband of Fig. 9;  
3           Fig. 12 is a schematic fragmentary perspective view  
4           showing a diaper having a waistband in accordance with  
5           another embodiment of the invention, the diaper being  
6           shown in a configuration as if fitted to an infant and  
7           having both of the fastener belts opened;  
8           Fig. 13 is a schematic perspective view on an  
9           enlarged scale of the waistband of the diaper shown in  
10          Fig. 12 with the fastener belts engaged; and  
11          Fig. 14 is a schematic perspective view showing a  
12          roll supply of the faster belt of the waistband of the  
13          diaper of Fig. 12.

#### 14           DETAILED DESCRIPTION OF THE DRAWINGS

15          Referring to Fig. 1, a disposable diaper 10  
16          comprises a laminate or layered assembly 12. The diaper  
17          10 has a generally I-shape configuration including a  
18          first end 14 and a second end 16 connected by  
19          longitudinally extending edges 18 and 20. The diaper 10  
20          includes a back portion 22 and a front portion 24  
21          connected by an intermediate portion 26.

22          The diaper 10 has a backsheet 28, a top sheet 30 and  
23          an absorbent core or pad 32. The top sheet 28 and  
24          backsheet 30 are sealed together along the longitudinal  
25          edges 22 and 24 of the diaper.

26          The top sheet 28 may be formed of liquid-permeable,  
27          substantially hydrophobic material, such as a spun bonded  
28          web of synthetic filaments. The backsheet 30 may be a  
29          thin sheet or film of polyolefin material as is well  
30          known in the art. The core 26 may comprise a liquid  
31          retaining pad of hydrophilic fibers, such as cellulosic  
32          fibers commonly referred to as fluff, possibly blended  
33          with synthetic polyolefin fibers.

1           The diaper 10 includes a waistband or waistbelt  
2       assembly 34 comprising an essentially tubular belt  
3       support loop 36 having opposed fastener belts 38 mounted  
4       at each open end thereof in a permanent factory joint  
5       38a. The loop 36 may be formed by an extension of the  
6       backsheet 28 or the top sheet 30 or by a separate strip  
7       portion secured to the adjacent edges of the sheets 28  
8       and 30. In each such arrangement, the diaper 10 is  
9       provided with a closed end 14 that does not expose the  
10      infant user to irritating cut edges of plastic or other  
11      laminate materials.

12           The loop 36 may include soft filler such as  
13      polymeric foam, cellulosic tissue, fibrous padding or  
14      other fluffy material to provide further comfort and  
15      enhanced sealing against the baby's body. The loop 36 is  
16      thereby provided with a filled and pleated appearance  
17      adding to the attractiveness of the diaper.

18           The fastener belt 38 includes a mounting portion 42  
19      and an engaging portion 44 including snap nubs 44a (Figs.  
20      2 and 3). In order to assure sufficient flexibility and  
21      extensibility in the belt construction, the mounting  
22      portion 42 is shirred with the use of corrugations or  
23      flutes 46 formed therein. The corrugations 46 may be  
24      formed during the molding or stamping of the belt or in  
25      other conventional manners. The belt is formed of a  
26      sufficiently strong material to allow tensioning of the  
27      waistband. The belt may be formed of conventional diaper  
28      construction materials such as polypropylene, polyester,  
29      polyethylene and nylon as well as blends and copolymers.

30           A landing zone 48 is permanently mounted to the  
31      backsheet 28 of the diaper adjacent the end 16. As shown  
32      in Figs. 1-3, the landing zone 48 comprises an array of  
33      recesses 50 having openings 50b sized to resiliently and  
34      matingly receive the snap nubs 44a on the fastener belt  
35      36. The convex and concave surfaces of the engaging



1 portions 44 and 50 are substantially larger than the  
2 cross-sectional areas of the snap nubs 44b and openings  
3 50b. The landing zone 48 may be formed of a low density  
4 polyethylene material having the recesses formed therein  
5 by heat stamping.

6 Referring to Fig. 2, the waist belt assembly 34 is  
7 shown in a fitted configuration wherein the landing zone  
8 48 is disposed between the belts 38 for engagement  
9 therewith. The belt 38 at the right side of the diaper  
10 10 is shown engaged with one of the recesses 50 and the  
11 belt 38 at the left side of the diaper is open for  
12 tensioning prior to engagement.

13 Referring to Fig. 4, a diaper 60 of the same general  
14 construction as the diaper 10 is provided with a  
15 waistband or waist belt assembly 62. The waist belt  
16 assembly 62 includes a tubular belt support loop 64 and  
17 opposed fastener belts 66. The waist belt assembly 62 is  
18 similar to the waist belt assembly 34 in all major  
19 respects except for the closure system as described  
20 below.

21 The belts 66 are formed of flexible polymeric  
22 diaper construction materials and include an array nubs  
23 68 adapted to interlock with a similar array of  
24 depressions 70 provided in the landing zone member 72.  
25 The nubs 68 and depressions 70 are surrounded by  
26 substantially flat or planar belt surfaces adapted to be  
27 disposed in overlying contiguous engagement when the  
28 fastener is closed.

29 Referring to Fig. 5, the nubs 68 are sized to be  
30 received with a resilient fit in the depressions 70.  
31 Upon engagement, a very strong closure is obtained since  
32 a relatively large number of interlocks are formed. The  
33 nubs 68 may range in diameter size from 1/32" to 3/8".

1           The belts 66 and landing zone member 68 may be  
2       formed of conventional diaper construction materials such  
3       as polyethylene, polypropylene, polyester or nylon.  
4       These materials may be shaped using conventional molding,  
5       extrusion and casting processes.

6           Referring to Fig. 6, a diaper 80 of the same general  
7       construction as the diaper 10 is provided with a  
8       waistband or waist belt assembly 82. The waist belt  
9       assembly 82 includes a tubular belt support loop 84 and  
10      opposed fastener belts 86. The belts 86 are shown in an  
11      open condition in Fig. 6 and in a closed condition in  
12      Fig. 7. The waist belt assembly 82 is similar to the  
13      waist belt assembly 34 in all major respects except for  
14      the closure system as described below.

15          The belts 86 are formed with a corrugated surface  
16      portion 88 adapted to interlock with a similar corrugated  
17      surface portion 90 provided by the landing zone 92 as  
18      best shown in Fig. 8. The belts 86 and landing zone  
19      member 88 may be formed of conventional diaper  
20      construction materials such as polyethylene,  
21      polypropylene, polyester or nylon. These materials may  
22      be shaped using conventional molding, extrusion and  
23      casting processes.

24          The interlocked corrugated surface portions 88 and  
25      90 provide the equivalent of adhesive shear strength. In  
26      order to further enhance the closure strength, the  
27      surface portions 88 may be coated with a pressure-  
28      sensitive adhesive. The pressure-sensitive adhesive may  
29      be acrylic or rubber based pressure-sensitive adhesives.  
30      Preferred adhesives include hot melt adhesives such as  
31      the adhesives taught in US Patent 3,932,328.  
32      Alternatively, both surface portions 88 and 90 may be  
33      coated with a cohesive material. Useful cohesives are  
34      disclosed in US Patent 5,085,655. The tack strength

1 provided by the adhesive or cohesive materials prevents  
2 the closure from unexpectedly opening.

3 Referring to Figs. 9 and 10, a diaper 100 of the  
4 same general construction as the diaper 10 is provided  
5 with a waistband or waist belt assembly 102. The waist  
6 belt assembly 102 includes a tubular belt support loop  
7 104 and opposed fastener belts 106. The belt 106 on the  
8 right side of the diaper is shown in a closed condition  
9 and the left belt 106 is shown in an open condition in  
10 Fig. 10. The waist belt assembly 102 is similar to the  
11 waist belt assembly 34 in all major respects except for  
12 the closure system as described below.

13 The belts 106 are formed with an array of convex  
14 protruding members 108 adapted to interlock with a  
15 similar array of concave receiving members 110 provided  
16 by the landing zone 112 as best shown in Fig. 11. The  
17 belts 106 and landing zone member 112 may be formed of  
18 conventional diaper construction materials such as  
19 polyethylene, polypropylene, polyester or nylon. These  
20 materials may be shaped using conventional molding,  
21 extrusion and casting processes.

22 The interlocked surfaces of the members 108 and 110  
23 provide the equivalent of adhesive shear strength. In  
24 order to further assure the closure, the surfaces of the  
25 members 108 may be coated with a pressure-sensitive  
26 adhesive. The pressure-sensitive adhesive may be acrylic  
27 or rubber based pressure-sensitive adhesives. Preferred  
28 adhesives include hot melt adhesives such as the  
29 adhesives taught in US Patent 3,932,328. Alternatively,  
30 the surfaces of both members 108 and 110 may be coated  
31 with a cohesive material. Useful cohesives are disclosed  
32 in US Patent 5,085,655. The tack strength provided by  
33 the adhesive or cohesive materials prevents the closure  
34 from unexpectedly opening.

1           The members 108 and 110 are generally ellipsoid in  
2 shape and may range in size from 1/8" to 1/2" in diameter  
3 along the short diameter, the long diameter being about  
4 1" long. Of course, it should be appreciated that the  
5 convex and concave members may have a variety of shapes  
6 such as spherical, conical or box-like.

7           Referring to Figs. 12, 13 and 14, a diaper 120 of  
8 the same general construction as the diaper 10 is  
9 provided with a waistband or waist belt assembly 122.  
10 The waist belt assembly 122 includes a tubular belt  
11 support loop 124 and opposed fastener belts 126. The  
12 belts 126 are shown in an open condition in Fig. 12 and  
13 in a closed condition in Fig. 13. The waist belt  
14 assembly 122 is similar to the waist belt assembly 34 in  
15 all major respects except for the closure system as  
16 described below.

17           Each of the belts 126 is provided with one or more  
18 rigid tab members 128 having a flat configuration and  
19 being slightly spaced from the surface of the belt to  
20 which it is mounted and has a pivotal type connection to  
21 the belt. The tab member 128 has a guitar pick shape  
22 including a tapered trailing end. The member 128 is  
23 adapted to be received in a slot opening 130 provided by  
24 landing zone member 132. As shown, a plurality of slot  
25 openings 130 may be provided to allow for size adjustment  
26 of the diaper upon closure. The slot openings 130 should  
27 be formed of a material sufficiently strong to resist the  
28 loads imposed by the member 128.

29           As indicated above, a plurality of members 128 may  
30 be provided at spaced locations along the length of the  
31 belt 126. The members 128 may range in length, width and  
32 thickness from about 1" x 1" x 1/8" to 1/64" x 1/64" x  
33 0.001". It is also possible to arrange the members 128  
34 in side-by-side relationship on the belt 128. In the  
35 later case, smaller sizes must be used.

1           The closure may be further enhanced by the use of a  
2   pressure-sensitive adhesive layer 134 which adheres to  
3   the landing zone 132 to inhibit disengagement movement of  
4   the member 128.

5           Cohesives may also be used if applied to both the  
6   belt 126 and the landing zone 132. The above described  
7   adhesives and cohesives may be used.

8           It should be evident that this disclosure is by way  
9   of example and that various changes may be made by  
10   adding, modifying or eliminating details without  
11   departing from the fair scope of the teaching contained  
12   in this disclosure. The invention is therefore not  
13   limited to particular details of this disclosure except  
14   to the extent that the following claims are necessarily  
15   so limited.

## WHAT IS CLAIMED IS:

1           1. A disposable diaper comprising a layered  
2 assembly extending between first and second diaper ends  
3 connected by opposed longitudinal edges, waist band means  
4 adjacent said first diaper end and a fastening system  
5 movable between an open and a closed position for  
6 releasably securing said diaper to a user, said layered  
7 assembly comprising a laminate of generally rectangular  
8 laminate members including a liquid permeable top sheet,  
9 a liquid impermeable backsheet, and an absorbent pad  
10 intermediate the top sheet and backsheet, said laminate  
11 members extending to at least one edge adjacent said  
12 first diaper end, said waist band means forming a tubular  
13 belt loop extending along said first diaper end to  
14 eliminate exposure of said at least one edge of said  
15 laminate member to said diaper user, said tubular belt  
16 having spaced first and second ends respectively  
17 positioned adjacent associated ones of said longitudinal  
18 edges of said diaper, said fastening system including a  
19 fastener belt mounted at each end of the waist band loop,  
20 each of said fastener belts extending from a mounting  
21 portion within said tubular loop to an engaging portion  
22 extending from said tubular loop, said mounting portion  
23 being fixed to said diaper by a user joint enclosed  
24 within said tubular loop, and said tubular loop thereby  
25 also eliminating exposure of said factory joint to said  
26 diaper user.

1           2. A diaper as in claim 1, wherein said tubular  
2 loop extends from one of said longitudinal edges to the  
3 other of said longitudinal edges.

1           3. A diaper as in claim 1, wherein said fastening  
2 belt has a length extending laterally between said  
3 longitudinal edges and a width extending longitudinally  
4 in alignment with said longitudinal edges, said mounting  
5 and engaging portions being positioned at spaced  
6 locations along the length of said fastening belt, said  
7 tubular loop having a flattened shape and a  
8 longitudinally extending major opening dimension  
9 substantially corresponding in size with the width of  
10 said fastening belt.

1           4. A diaper as in claim 3, wherein said tubular  
2 loop includes soft filler to further enhance user comfort  
3 and sealing against the user's body.

1           5. A diaper as in claim 4, wherein said fastener  
2 belts include extensibility means for resiliently  
3 fastening said diaper about the user.

1           6. A diaper as in claim 5, wherein said  
2 extensibility means include corrugations in said mounting  
3 portions of said fastening belts.

1           7. A diaper as in claim 1, wherein said engaging  
2 portion includes a first fastening means engageable with  
3 a second fastening means carried by a landing zone fixed  
4 to said second diaper.

1           8. A diaper as in claim 7, wherein said first  
2 fastening means comprises a first mechanical fastening  
3 element positioned adjacent said engaging portion of each  
4 of said fastening belts, said second fastening means  
5 comprises a second mechanical fastening element carried  
6 by said landing zone, said first and second fastening  
7 elements each including engaging surface means including

8 mating surfaces having contiguous engagement surface  
9 portions and mechanically interlocking surface portions,  
10 said contiguous engaging surface portions being  
11 substantially larger than said mechanically interlocking  
12 surface portions.

1 9. A diaper as in claim 7, wherein said first  
2 fastening means comprises a first mechanical fastening  
3 element positioned adjacent each end of said engaging  
4 portion of said fastening belt, said first fastening  
5 element including a convex disc-shaped engaging surface  
6 having a centrally located and protruding snap nub, said  
7 second fastening means comprises a plurality of second  
8 mechanical fastening elements carried by said landing  
9 zone, said second fastening element including a concave  
10 disc-shaped engaging surface having a centrally located  
11 aperture for resiliently receiving said snap nub, said  
12 convex and concave disc-shaped engaging surfaces being  
13 similarly curved to matingly engage as said snap nub is  
14 received in said aperture.

1 10. A diaper as in claim 9, wherein said convex and  
2 concave disc-shaped engaging surfaces having similarly  
3 sized areas, said snap nub and aperture having similarly  
4 sized cross-sectional areas, said areas of said convex  
5 and concave disc-shaped engaging surfaces being  
6 substantially greater than the cross-sectional areas of  
7 said snap nub and aperture.

1 11. A diaper as in claim 10, wherein said landing  
2 zone includes five concave disc-shaped engaging surfaces  
3 spaced along said second end of said diaper.



1           12. A diaper as in claim 11, wherein said tubular  
2       loop extends from one of said longitudinal edges to the  
3       other of said longitudinal edges, said fastening belt has  
4       a length extending laterally between said longitudinal  
5       edges and a width extending longitudinally in alignment  
6       with said longitudinal edges, said mounting and engaging  
7       portions being positioned at spaced locations along the  
8       length of said fastening belt, said tubular loop having a  
9       flattened shape and a longitudinally extending major  
10      opening dimension substantially corresponding in size  
11      with the width of said fastening belt.

1           13. A diaper as in claim 7, wherein said first  
2       fastening means comprises a first mechanical fastening  
3       element positioned adjacent said engaging portion of each  
4       of said fastening belts, said first fastening element  
5       including a first flat engaging surface having a  
6       plurality of projecting snap nubs, said second fastening  
7       means comprising a second mechanical fastening element  
8       carried by said landing zone, said second fastening  
9       element comprising a second flat engaging surface having  
10      a plurality of apertures for resiliently receiving said  
11      snap nubs, said first and second engaging surfaces being  
12      substantially contiguously superposed when to said snap  
13      nubs are received in said apertures.

1           14. A diaper as in claim 13, wherein said snap nubs  
2       and apertures are each arranged in a similar array, said  
3       array of aperture extending along said second end of said  
4       diaper.

1           15. A diaper as in claim 13, wherein said snap nubs  
2       have diameters in the range of from about 1/32" to about  
3       3/8".

1           16. A diaper as in claim 15, wherein said tubular  
2 loop extends from one of said longitudinal edges to the  
3 other of said longitudinal edges, said fastening belt has  
4 a length extending laterally between said longitudinal  
5 edges and a width extending longitudinally in alignment  
6 with said longitudinal edges, said mounting and engaging  
7 portions being positioned at spaced locations along the  
8 length of said fastening belt, said tubular loop having a  
9 flattened shape and a longitudinally extending major  
10 opening dimension substantially corresponding in size  
11 with the width of said fastening belt.

1           17. A diaper as in claim 7, wherein said first  
2 fastening means comprises a first mechanical fastening  
3 element positioned adjacent said engaging portion of each  
4 of said fastening belts, said first fastening element  
5 including a first corrugated surface having a plurality  
6 of alternating first ridges and grooves, said second  
7 fastening means comprising a second mechanical fastening  
8 element carried by said landing zone, said second  
9 fastening element comprising a second corrugated surface  
10 having a plurality of alternating second ridges and  
11 grooves, said first and second ridges and grooves being  
12 similarly sized for mating interengagement in overlying  
13 relationship upon closure of said fastening system, and  
14 contact securement means disposed along at least one of  
15 said first and second corrugated surfaces, said contact  
16 securement means providing tack strength and said  
17 interengagement of said overlying corrugated surfaces  
18 providing shear strength when said fastening system is in  
19 said closed position.

1           18. A diaper as in claim 17, wherein said contact  
2           securement means comprises a layer of pressure-sensitive  
3           adhesive disposed along said second corrugated surface.

1           19. A diaper as in claim 17, wherein said contact  
2           securement means comprises a layer of cohesive disposed  
3           along each of said corrugated surfaces.

1           20. A diaper as in claim 17, wherein said tubular  
2           loop extends from one of said longitudinal edges to the  
3           other of said longitudinal edges, said fastening belt has  
4           a length extending laterally between said longitudinal  
5           edges and a width extending longitudinally in alignment  
6           with said longitudinal edges, said mounting and engaging  
7           portions being positioned at spaced locations along the  
8           length of said fastening belt, said tubular loop having a  
9           flattened shape and a longitudinally extending major  
10          opening dimension substantially corresponding in size  
11          with the width of said fastening belt.

1           21. A diaper as in claim 7, wherein said first  
2           fastening means comprises a first mechanical fastening  
3           element positioned adjacent said engaging portion of each  
4           of said fastening belts, said first fastening element  
5           including at least one convex engaging surface, said  
6           second fastening means comprises a second mechanical  
7           fastening element carried by said landing zone, said  
8           second fastening element including a plurality of concave  
9           engaging surfaces, said convex and concave engaging  
10          surfaces being similarly curved to matingly engage upon  
11          closure of said fastening system.

1           22. A diaper as in claim 21, wherein said fastening  
2 system also includes contact securement means disposed  
3 along at least one of said first and second engaging  
4 surfaces, said contact securement means providing tack  
5 strength and said mating engagement of said engaging  
6 surfaces providing shear strength when said fastening  
7 system is in said closed position.

1           23. A diaper as in claim 21, wherein said contact  
2 securement means comprises a layer of adhesive disposed  
3 along said first engaging surfaces.

1           24. A diaper as in claim 21, wherein said contact  
2 securement means comprises a layer of cohesive disposed  
3 along each of said engaging surfaces.

1           25. A diaper as in claim 21, wherein said engaging  
2 surfaces have an ellipsoid shape, and have a major  
3 diameter of about 1" and a minor diameter of from about  
4 1/8" to about 1/2".

1           26. A diaper as in claim 21, wherein said tubular  
2 loop extends from one of said longitudinal edges to the  
3 other of said longitudinal edges, said fastening belt has  
4 a length extending laterally between said longitudinal  
5 edges and a width extending longitudinally in alignment  
6 with said longitudinal edges, said mounting and engaging  
7 portions being positioned at spaced locations along the  
8 length of said fastening belt, said tubular loop having a  
9 flattened shape and a longitudinally extending major  
10 opening dimension substantially corresponding in size  
11 with the width of said fastening belt.

1           27. A diaper as in claim 7, wherein said first  
2 fastening means comprises a first mechanical fastening  
3 element positioned adjacent each end of said engaging  
4 portion of said fastening belt, said first fastening  
5 element including at least rigid flat member pivotally  
6 connected to said fastening belt, said second fastening  
7 means comprises a second mechanical fastening element  
8 carried by said landing zone, said second fastening  
9 element including a plurality of openings for receiving  
10 said flat members, said flat members being engaged within  
11 associated openings when said fastening system is in said  
12 closed position.

1           28. A diaper as in claim 27, wherein said fastening  
2 system also includes contact securement means disposed  
3 either said engaging portions of said fastener belts or  
4 said landing zone.

1           29. A diaper as in claim 28, wherein said contact  
2 securement means comprises a layer of adhesive disposed  
3 along said engaging portions of said fastening belts.

1           30. A diaper as in claim 21, wherein said contact  
2 securement means comprises a layer of cohesive disposed  
3 along each of said engaging portions of said fastening  
4 belts and said landing zone.

1           31. A diaper as in claim 21, wherein said first  
2 fastening means comprises a first mechanical fastening  
3 element positioned adjacent each end of said engaging  
4 portion of said fastening belt, said first fastening  
5 element including at least rigid flat member pivotally  
6 connected to said fastening belt, said second fastening  
7 means comprises a second mechanical fastening element  
8 carried by said landing zone, said second fastening

9 element including a plurality of openings for receiving  
10 said flat members, said flat members being engaged within  
11 associated openings when said fastening system is in said  
12 closed position.

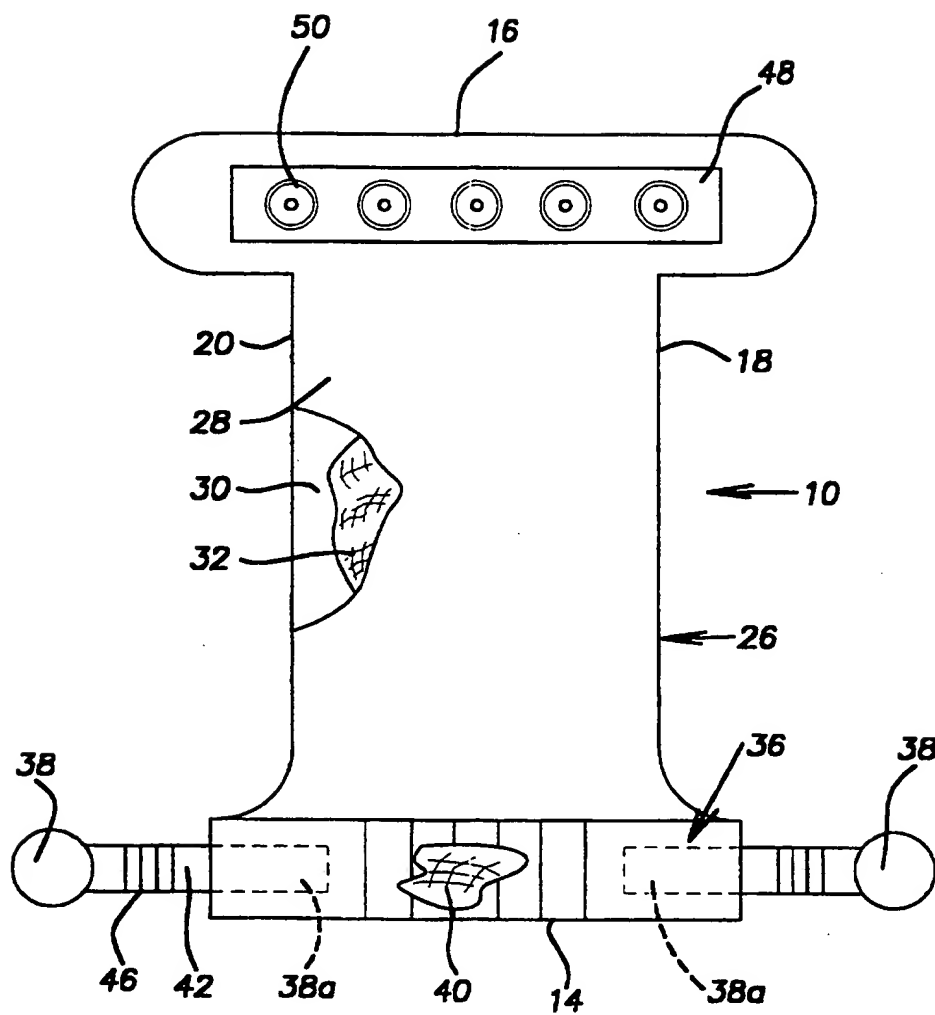


Fig.1

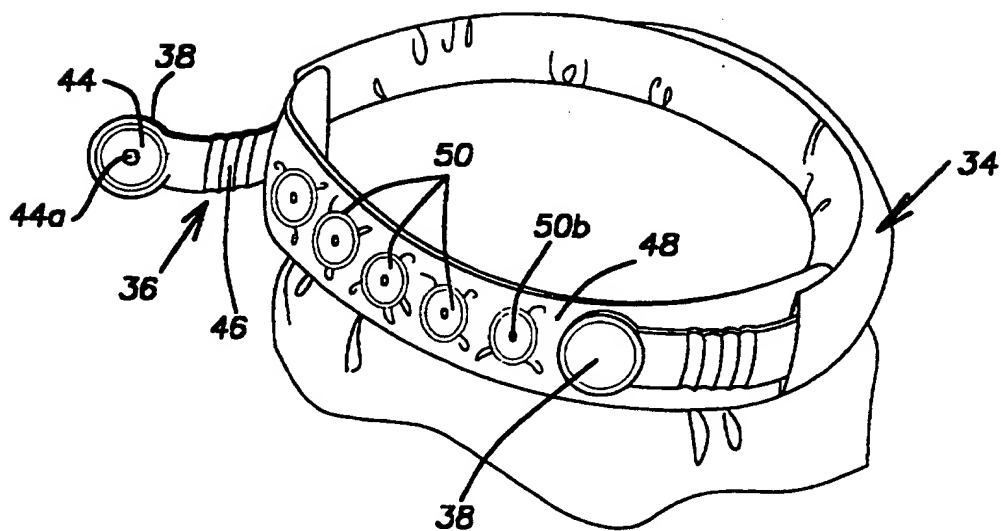


Fig.2

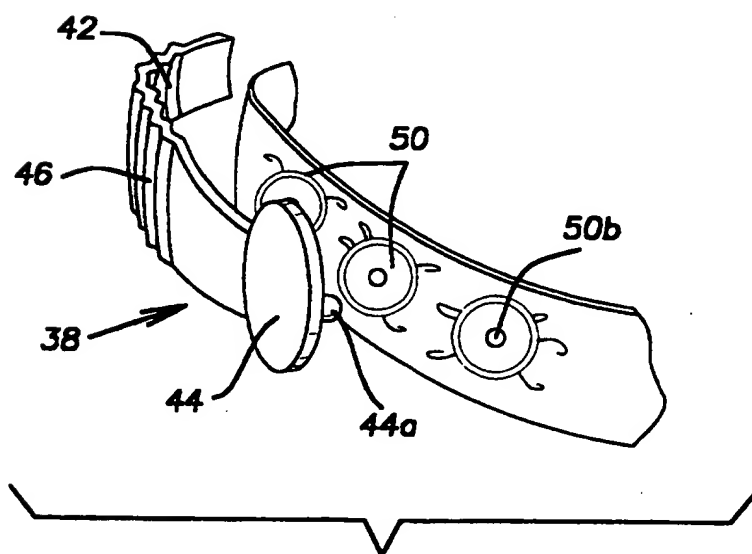


Fig.3



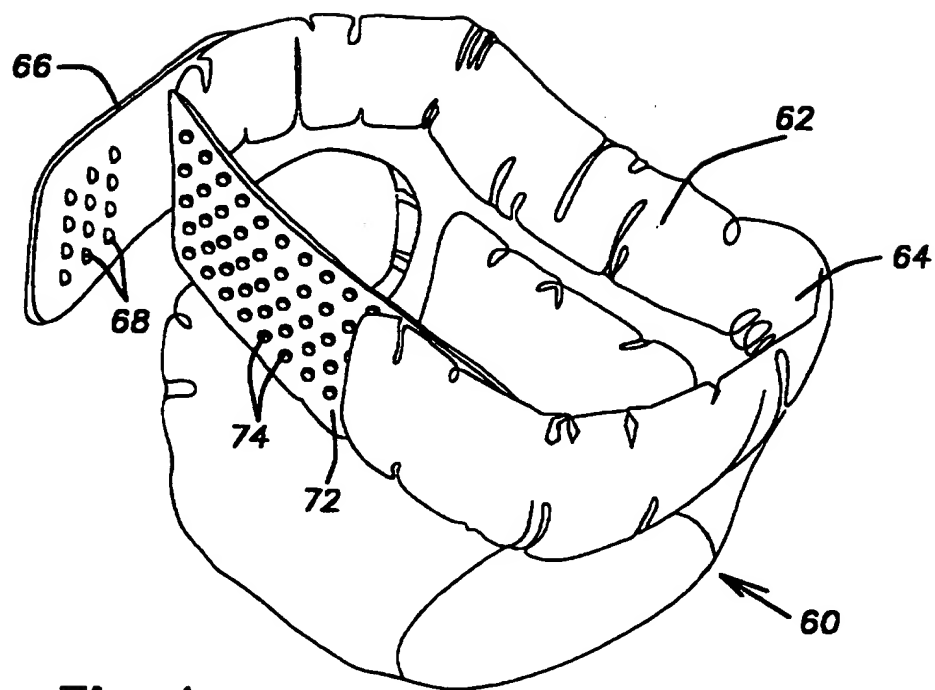


Fig.4

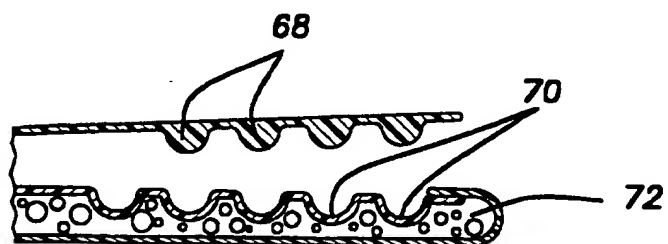


Fig.5

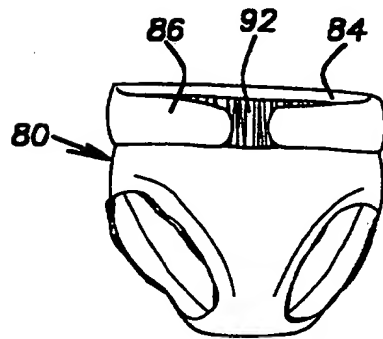
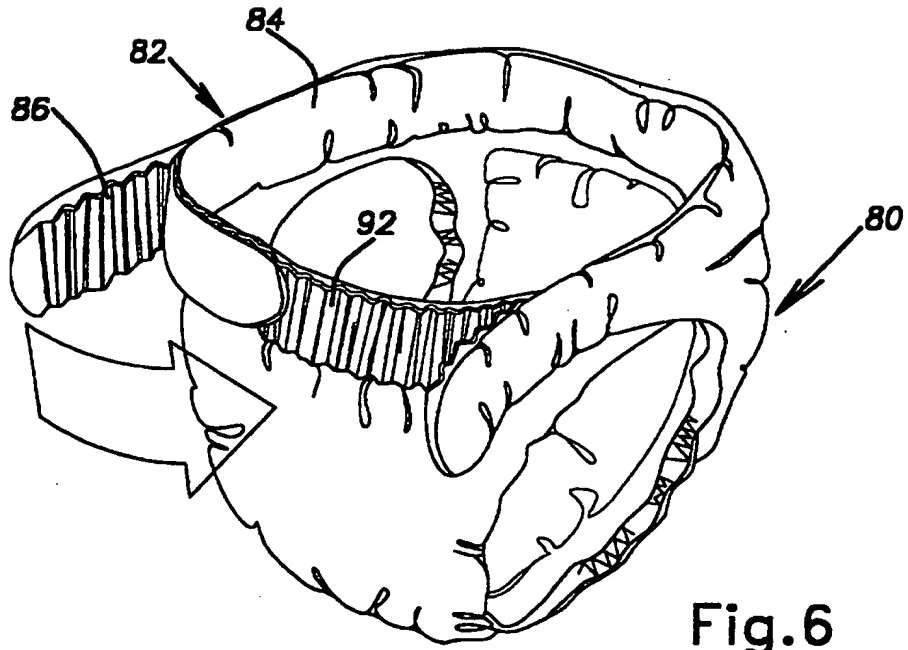


Fig. 7

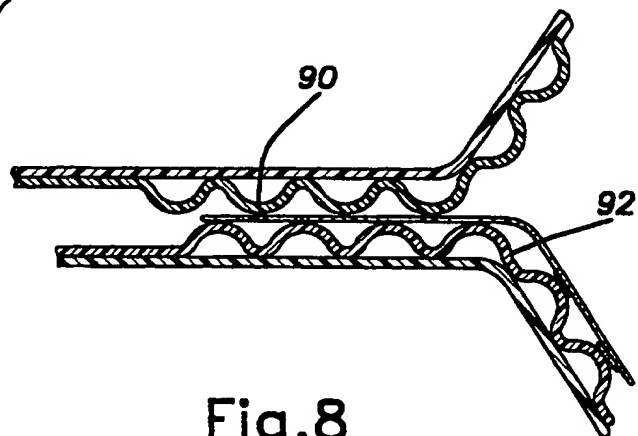
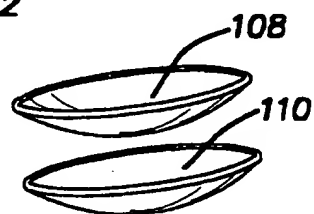
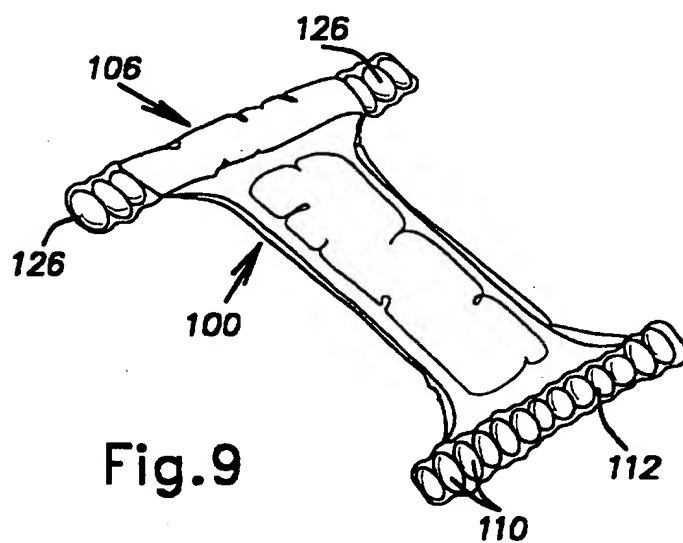
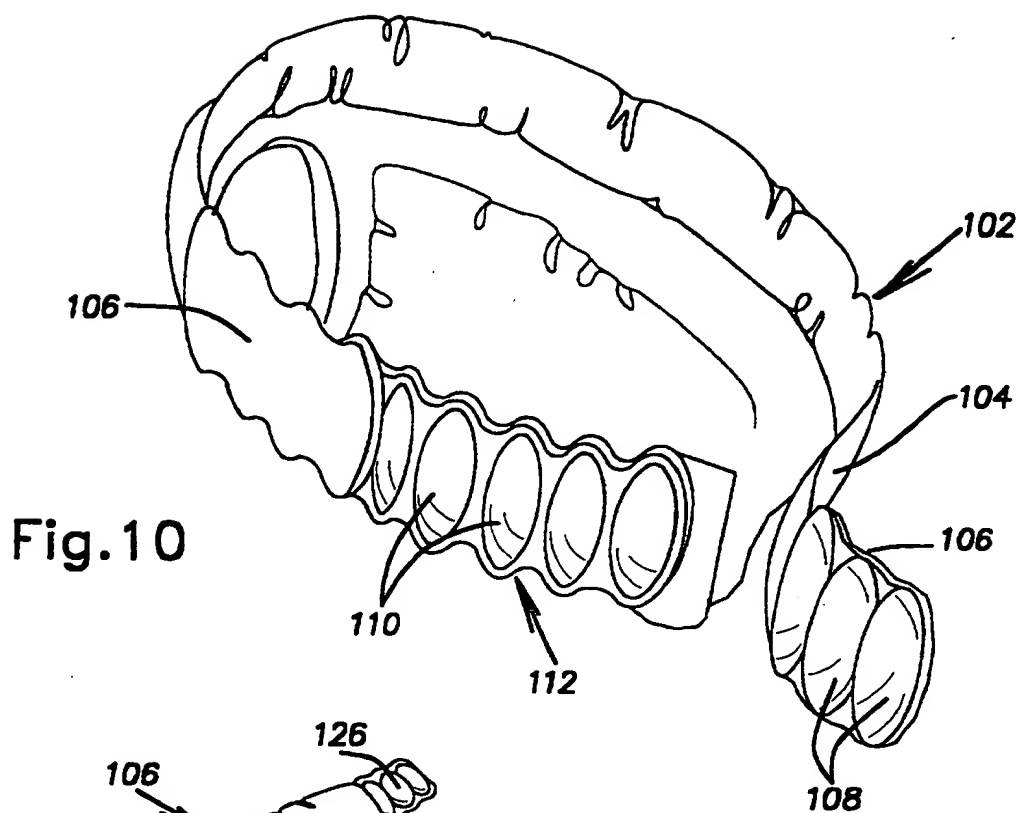
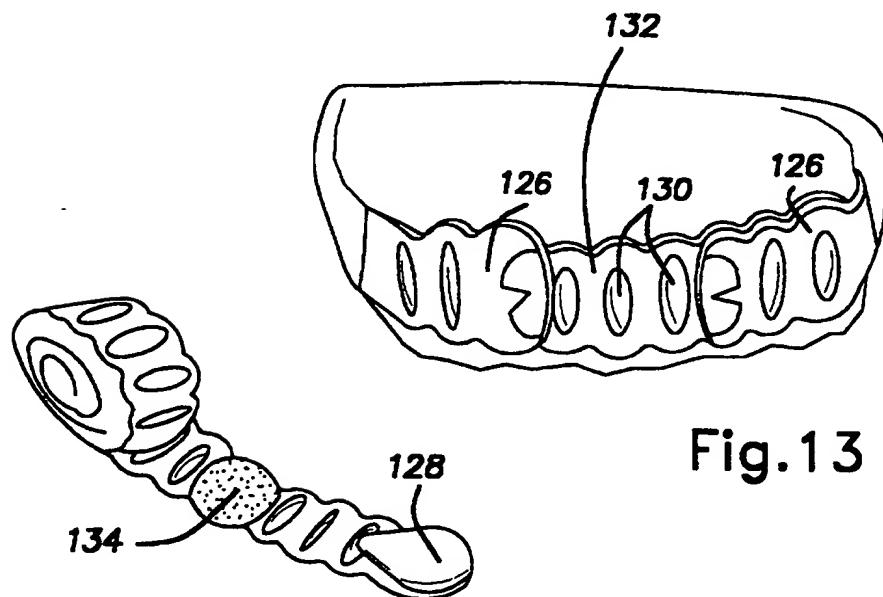
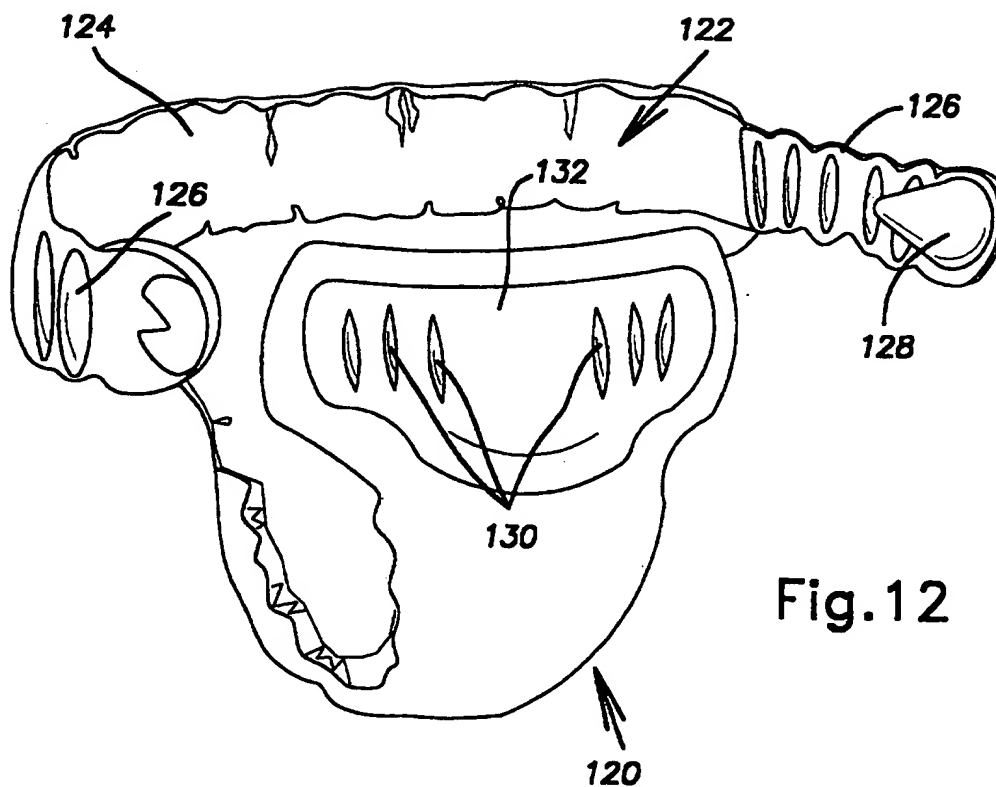


Fig. 8





## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US97/03008

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :A61P 13/15

US CL :604/385.1, 385.2, 386, 389-392

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 604/385.1, 385.2, 386, 389-393

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4,670,012 A (JOHNSON) 02 June 1987, figures.	1, 5, 6
A	US 5,221,276 A (BATTRELL) 22 June 1993, figures.	1, 7, 13-19, 21-25, 27-30
A	US 5,269,776 A (LANCASTER et al) 14 December 1993, figures.	1-3, 7, 8, 12-31
A	US 2,606,558 A (KENNETTE) 12 August 1952, Fig. 5.	8-11

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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Date of the actual completion of the international search

15 APRIL 1997

Date of mailing of the international search report

25 APR 1997

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